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USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 43. F-100F IN--ETC(U)
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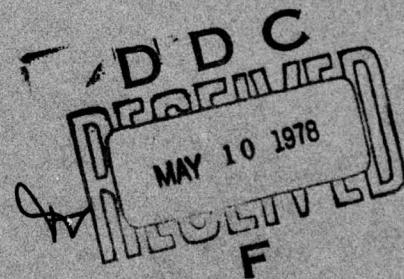
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK

v.44 AD-A048 832

Volume 43

F-100F In-Flight Crew Noise

OCTOBER 1975



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AEROSPACE MEDICAL RESEARCH LABORATORY
AEROSPACE MEDICAL DIVISION
AIR FORCE SYSTEMS COMMAND
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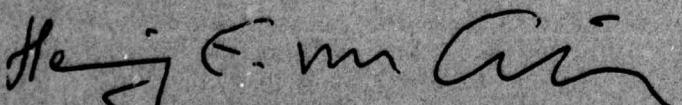
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FOR THE COMMANDER


**HENNING E. VON GIERKE
Director
Biodynamics and Bioengineering Division
Aerospace Medical Research Laboratory**

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AMRL-TR-75-50, Vol. 43		
14 (U) AMRL-TR-75-50-VOL-43		
6 4. TITLE (and Subtitle) USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK F-100F In-flight Crew Noise Volume 43		
10 5. GOVT ACCESSION NO.		
6. PERFORMING ORG. REPORT NUMBER		
7. AUTHOR(s) Justus F. Rose, Jr., Col, USAF Nick A. Farinacci, Capt, USAF, BSC		
8. CONTRACT OR GRANT NUMBER(s)		
9. PERFORMING ORGANIZATION NAME AND ADDRESS Aerospace Medical Research Laboratory Aerospace Medical Division, Air Force Systems Command, Wright-Patterson AFB, OH 45433		
10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62202F 7231-4-18		
11. CONTROLLING OFFICE NAME AND ADDRESS Same as above		
12. REPORT DATE Oct 1975		
13. NUMBER OF PAGES 17		
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		
15. SECURITY CLASS. (of this report) Unclassified		
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE		
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Noise Noise Environments Bioenvironmental Noise In-flight Crew Noise F-100F Aircraft		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The F-100F is a USAF two-seat supersonic fighter-bomber, air-superiority fighter or trainer. This report provides measured data defining the bio-acoustic environments at flight crew locations inside this aircraft during normal flight operations. Data are reported for one location in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total		

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daily exposure of personnel with and without standard Air Force ear protectors. Refer to Volume 1 of this handbook, "USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application", AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc.



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PREFACE

This report was prepared by the Biodynamic Environment Branch, Aerospace Medical Research Laboratory, under Project/Task 723104, Measurement and Prediction of Noise Environments of Air Force Operations. Col Justus F. Rose, Jr. conducted the field measurements and performed the data analysis; Capt Nick Farinacci and Capt Richard Goeman prepared this report. Noise data are also included that were extracted from noise surveys performed by Lt Col Donald Gasaway, USAF School of Aerospace Medicine. These data describe environments for three test conditions while create noise levels higher than those measured during Aerospace Medical Research Laboratory surveys.

The authors acknowledge the efforts of Mr. John N. Cole who established the data analysis requirements and assisted in the preparation of this report, and Mr. Henry Mohlman and Mr. David Eilerman of the University of Dayton who assisted in the mechanics of data processing.

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boarded without exception. Boarding procedures will be followed beginning one month after the first flight and will continue until all passengers have boarded. Boarding procedures will be conducted under supervision of the chief flight attendant. Boarding will begin at least 30 minutes before departure time and will be completed within 15 minutes of departure. Boarding times will be determined by the chief flight attendant based on the number of passengers and the type of aircraft.

Table of Contents

	Page
INTRODUCTION	3
IN-FLIGHT NOISE	4

List of Tables

1. Measurement Location and Test Conditions for Noise Measurements	4—5
2. Measured Sound Pressure Level 1/3 Octave Band	6—7
Octave Band	8—10
3. Measures of Human Noise Exposure	11—13

INTRODUCTION

The F-100F is a USAF two-seat supersonic fighter-bomber, air-superiority fighter or trainer manufactured by North American Aviation, Incorporated, Los Angeles and Columbus Divisions. Power is provided by one J57-P-21 or 21A turbojet engine rated at 16,000 lbs maximum take-off thrust with afterburner. The engine is manufactured by the United Aircraft Corporation, Pratt & Whitney Aircraft Division.

This volume provides measured data defining the bioacoustic environments produced inside the aircraft. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the F-100F aircraft.

This volume is one of a series published by the Aerospace Medical Research Laboratory (AMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force aircraft and aerospace ground equipment. The far-field, community-type, noise data in the handbook describe the noise produced during *ground operations* of aircraft, aerospace ground equipment, and other ground-based equipment or facilities.

Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. Refer to Volume 1 (reference 1) for such information because it is not repeated in other handbook volumes.

A cumulative index lists those aerospace systems contained in the handbook, and identifies the specific volumes containing each type of environmental noise data available (i.e., in-flight/flight crew and passenger noise, near-field/ground crew noise, far-field/community noise). Volume numbers are assigned sequentially as individual volumes are published. This index is periodically updated as individual volumes are published, and is available upon request from AMRL/BBE, Wright-Patterson AFB, OH 45433. Organizations on the distribution list for the handbook will automatically receive a copy of the updated index as it is generated.

Direct any questions concerning the technical data in this report and other handbook volumes to: AMRL/BBE, Wright-Patterson AFB, OH 45433; Autovon 78-53675 or 78-53664; Commercial (513) 255-3675 or (513) 255-3664.

1. Cole, John N., *USAF Bioenvironmental Noise Data Handbook, Volume 1: Organization, Content and Application*, AMRL-TR-75-50 (1), Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, 1975.

IN-FLIGHT NOISE

MEASUREMENTS

All noise measurements were made on-board a standard-configured F-100F aircraft during typical speed, altitude, and flight maneuver conditions. These levels describe the standard F-100F environments, but may not be representative of those levels encountered if the aircraft has been configured differently (e.g., major equipment or structural changes).

Acoustic measurements were made at one flight crew location. Table 1 lists the measurement location and test conditions as numeric/alphabetic designators which are used on the data pages. The designator 1/A means measurement location 1 and test condition A.

The microphone was randomly moved external to the headgear in a region 0.2-0.3 meter from the head and the resultant samples analyzed using a 4- or 8-second integration time to obtain a power-averaged level that effectively smooths out short-duration fluctuations and best describes the exposure.

RESULTS

The measured data presented in Table 2 define the sound pressure levels (SPL) produced inside the F-100F aircraft at the specified location. This table includes the overall, 1/3 octave band, and octave band levels. From these data, C-weighted and A-weighted sound levels, maximum permissible time for one exposure per day (AFR 161-35) with and without standard Air Force ear protectors, preferred speech interference level, and perceived noise level are calculated and presented in Table 3. These measures are widely used to assess the effects of noise on personnel and their performance.

TABLE 1

MEASUREMENT LOCATION AND TEST CONDITIONS

F-100F, Eglin AFB, 14 Jul 1971

Serial # 56-3889

LOCATION	POSITION	HEIGHT ABOVE DECK
1	Rear Seat	Seated Head Level
CONDITION		
A	Ground power unit operating, canopy open.	
B	Engine start, ground power unit operating, canopy open.	
C	Taxiing, canopy open.	
D	Idle power setting, canopy open.	
E	Takeoff — afterburner.	
F	Initial acceleration to 300 knots, afterburner, gear and flaps up.	
G	Low altitude cruise — 360 KIAS, 92% RPM, .58M, 3.5M PA.	
H	Typical combat cruise — 460 KIAS, .72M, 95% RPM, 4.0M PA, full console airflow.	
I	Combat cruise — afterburner — 510 KIAS, .82M, 9.4M PA.	

TABLE 1 (Continued)
MEASUREMENT LOCATION AND TEST CONDITIONS

F-100F, Eglin AFB, 14 Jul 1971
 Serial # 56-3889

<i>CONDITION</i>	<i>DESCRIPTION</i>
J	Normal climb — 350 KIAS, .66M, 94% RPM, 10.0M PA ↗
K	Afterburner climb — 400 KIAS, .76M, 16.0M PA ↗
L	Intermediate altitude cruise — 330 KIAS, .73M, 92% RPM, 22.0M PA.
M	Climb — 340 KIAS, .78M, 94% RPM, 22.0M PA ↗ (data at 24.0M PA).
N	Afterburner climb — 350 KIAS, .85M, 26.0M PA ↗
P	High altitude cruise — 315 KIAS, .86M, 92% RPM, 33.0M PA.
Q	Penetration descent — 300 KIAS, .73M, 80% RPM, 33.0M PA ↗ speed brakes and defog.
R	Same as Q plus heat.
S	High speed idle descent — 410 KIAS, 68% RPM, 12.0M → 4.0M PA (no speed brakes).
T	Typical dive bomb pattern — roll-in through release.
U	Typical dive bomb pattern — recovery.
V	Pop-up maneuver — 500' to 5600'.
W	Pop-up maneuver — bomb run.
X	Strafing run — 450 KIAS.
Y	GCA configuration — 170 KIAS, 92% RPM, 3.0M PA, gear and flaps down, defog on.
USAFSAM Survey Kelly AFB, Aug 63	
AA	Normal cruise — 350, KIAS, 90% RPM, 5.0M PA, air on
BB	Normal cruise — 350 KIAS, 90.5% RPM, 5.0M PA, air off
CC	Normal cruise — 350 KIAS, 90.5% RPM, 22.0M PA, console on, defogger on

TABLE: MEASURED SOUND PRESSURE LEVEL (dB)
2
1/3 OCTAVE BAND

NOISE SOURCE/SUBJECT	OPERATION:										LOCATION/CONDITION			
	1/A	1/B	1/C	1/C MAX	1/D	1/E	1/F	1/G	1/H	1/I	1/J	1/K	1/L	
F-100F AIRCRAFT	64	79	84	86	83	86	83	83	83	88	98	95	83	
INFLIGHT NOISE LEVELS	77	81	86	86	81	86	84	84	84	86	96	95	85	78
	88	87	91	83	95	95	92	91	91	91	95	90	85	
	74	80	83	90	79	93	90	90	90	90	94	97	82	
	60	61	84	81	88	75	85	81	83	82	92	90	80	75
	100	83	82	79	85	79	91	86	87	89	86	92	88	83
	125	84	83	79	88	74	95	91	91	91	91	92	92	85
	160	73	82	83	91	77	95	92	90	90	88	89	89	83
	200	76	86	86	94	84	93	91	92	86	86	87	87	82
	250	61	68	68	98	86	96	94	93	92	89	88	89	85
	315	81	86	86	97	84	98	97	97	96	94	92	95	90
	400	77	84	86	94	83	96	95	97	95	96	92	94	88
	500	73	84	87	96	83	97	97	97	96	96	94	94	92
	630	74	90	92	99	86	98	98	99	98	98	96	97	92
	800	69	86	93	100	88	98	98	98	98	99	96	97	93
	1000	71	93	95	99	88	96	96	96	98	97	95	97	93
	1250	69	91	92	96	86	94	96	96	96	96	94	96	91
	1600	69	90	94	100	86	97	97	98	94	96	95	97	92
	2000	69	84	86	98	81	97	98	95	95	98	96	97	92
	2500	65	85	88	97	83	100	106	106	104	107	100	102	99
	3150	63	81	87	96	80	98	101	97	97	97	97	98	92
	4000	63	80	87	98	77	94	96	96	92	95	96	98	91
	5000	61	75	81	93	73	93	97	99	96	99	96	99	91
	6300	57	75	79	93	72	93	95	95	91	95	96	98	92
	8000	54	74	77	91	71	91	93	94	88	94	96	98	92
	10000	49	70	73	87	68	89	91	93	86	91	96	98	93
	12500	46	67	71	86	65	87	89	91	83	88	93	96	92
	16000	45	65	69	83	65	86	88	91	83	88	94	95	93
OVERALL		92	100	103	110	97	109	111	111	109	111	109	110	105

LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)
2 1/3 OCTAVE BAND

NOISE SOURCE/SUBJECT:	OPERATIONS:									
F-100F AIRCRAFT INFLIGHT NOISE LEVELS										

FREQ (HZ)	LOCATION/CONDITION										PAGE
	1/N	1/P	1/Q	1/R	1/S	1/T	1/U	1/V	1/W	1/X	
25	86	83	81	88	85	92	91	99	86	85	86
31.5	83	80	78	87	83	90	85	87	86	84	89
40	86	86	85	89	88	92	95	93	91	90	95
50	83	82	81	86	85	89	92	92	89	87	95
63	82	80	77	85	84	86	86	85	86	84	87
80	79	77	74	83	84	81	84	82	81	81	84
100	84	85	84	84	83	86	95	90	87	85	85
125	87	85	84	85	86	91	94	95	91	90	89
160	84	84	82	83	84	90	93	93	90	89	88
200	83	82	80	81	81	90	91	91	90	88	83
250	87	85	83	83	84	94	93	96	90	96	92
315	91	89	87	86	86	99	95	99	94	100	96
400	88	86	86	88	88	101	98	101	93	101	96
500	91	92	89	93	93	99	97	100	96	100	91
630	93	92	90	92	92	99	98	101	97	101	92
800	93	93	92	94	94	100	98	103	99	100	90
1000	93	92	91	94	94	99	98	102	98	100	97
1250	91	90	69	92	92	96	94	98	97	96	97
1600	93	91	91	93	93	95	98	100	96	99	98
2000	93	92	90	98	98	94	94	101	97	99	98
2500	99	98	97	92	94	92	91	104	108	96	109
3150	94	92	91	92	93	91	92	96	99	95	98
4000	92	90	88	95	96	91	88	96	95	96	94
5000	92	91	89	95	96	93	87	97	98	94	96
6300	93	92	91	97	97	94	85	93	94	91	93
8000	93	92	91	98	100	95	84	92	93	89	93
10000	94	93	92	101	102	98	84	91	91	89	91
12500	94	94	94	107	107	99	84	90	90	87	89
16000	93	92	90	107	108	103	87	92	89	88	94
OVERALL	106	105	104	112	113	111	108	112	111	111	109

LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TEST COMMAND TO SIGHT INFLIGHT NOISE LEVELS

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)
2 OCTAVE BAND

NOISE SOURCE/SUBJECT	(OPERATION)				LOCATION/CONDITION							
	1/A	1/B	1/C	1/D	1/E	1/F	1/G	1/H	1/I	1/J	1/K	1/L
FREQ (HZ)	MIN	MAX										
31.5	86	89	90	93	87	96	93	92	92	94	101	92
63	83	89	90	97	86	94	92	92	91	90	97	89
125	86	87	85	93	82	99	95	95	95	94	96	84
250	85	93	93	101	89	100	99	99	98	96	94	95
500	80	92	94	102	89	102	102	102	101	102	99	100
1000	74	96	98	103	92	101	101	101	102	103	100	101
2000	72	92	96	103	89	103	103	103	107	105	108	107
4000	67	84	90	101	82	100	100	102	103	102	101	103
8000	59	76	82	95	75	96	98	99	93	98	101	103
16000	49	69	73	88	68	90	92	94	86	91	96	95
OVERALL	92	100	103	110	97	109	111	111	109	111	110	105

IDENTIFICATION:

) TEST 71-014-050
) RUN 01.
) 03 JAN 75
) PAGE J1

TEST 71-014-050
 CHECK
 IDENTIFICATION

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)
2 OCTAVE BAND

NOISE SOURCE/SUBJECT:	OPERATION:	LOCATION/CONDITION										PAGE J2
		1/N	1/P	1/Q	1/R	1/S	1/T	1/U	1/V	1/W	1/X	
F-100F AIRCRAFT												
INFLIGHT NOISE LEVELS												
31.5	90	86	87	93	91	96	97	100	94	93	92	96
63	86	85	83	89	89	91	93	93	91	91	90	96
125	90	89	88	89	89	94	99	98	95	94	93	92
250	93	91	89	88	89	100	98	101	96	102	98	91
500	96	96	93	96	96	104	102	106	100	105	104	95
1000	97	97	95	97	98	103	101	106	103	104	102	95
2000	100	99	99	100	100	98	100	107	108	103	109	105
4000	97	96	94	99	100	96	94	101	102	100	102	101
8000	98	97	96	103	105	100	89	96	97	94	97	97
16000	96	96	96	110	111	105	89	94	92	90	92	96
OVERALL	106	105	104	112	113	111	108	112	111	111	112	109

TABLE 1
MEASURED SOUND PRESSURE LEVEL (DB)

2

NOISE SOURCE/SUBJECT:		OPERATION:		IDENTIFICATION:	
F-100F AIRCRAFT				OMEGA 3.2	
INFLIGHT NOISE LEVELS				TEST 71-014-050	
USAFSAM SURVEY - AUG 1963				RUN 02	
				04 NOV 77	
				PAGE F1	
LOCATION/CONDITION					
1/AA	1/BB	1/CC			
REQ (HZ)					
63	91	96			
125	94	101			
250	97	103			
500	100	105			
1000	105	105			
2000	105	106			
4000	102	107			
8000	92	97			
OVERALL	110	114			
		121			

LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE I MEASURES OF HUMAN NOISE EXPOSURE

3

NOISE SOURCE/SUBJECT*	OPERATION*	LOCATION/CONDITION) IDENTIFICATION:		
		1/A	1/B	1/C	1/C	1/D	1/E	1/F	1/G	1/H	1/I	1/J	1/K	1/L
		MIN	MAX											
F-100F AIRCRAFT INFLIGHT NOISE LEVELS														
OASLC	91	100	102	109	97	109	110	110	109	111	108	109	104	
OASLA	82	99	102	109	95	108	111	111	109	112	106	110	105	
T	679	36	21	6	71	8	4.5	4.5	6	4.5	8	5	13	
HGU-2A/P HELMET WITH H-154 OASLA*	77	85	86	82	94	94	95	93	94	94	96	94	91	
T	960	404	339	71	679	65	71	101	85	85	60	60	143	
HGU-2A/P HELMET WITH H-154(A) OASLA*	73	82	83	90	76	90	89	89	88	88	86	87	83	
T	960	679	571	170	960	170	202	202	240	240	339	285	571	
HGU-2A/P HELMET WITH CUSTOM LINER OASLA*	79	93	96	102	90	101	101	101	101	98	100	96	96	
T	960	101	60	21	170	25	25	25	30	25	42	30	60	
COMMUNICATION PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)														
PSIL	75	93	96	103	90	102	103	104	103	104	100	102	98	
ANNOYANCE PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNDB)														
TONE CORRECTION (C IN DB)														
PNLT	97	112	115	123	108	122	127	129	126	129	123	125	121	
C	1	2	1	1	1	0	2	3	3	3	1	1	2	

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

TABLE: MEASURES OF HUMAN NOISE EXPOSURE

3

NOISE SOURCE/SUBJECT:		(OPERATION:		LOCATION/CONDITION		1/M		1/N		1/P		1/Q		1/R		1/S		1/T		1/U		1/V		1/W		1/X		1/Y																						
HAZARD/PROTECTION																																																		
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DBC) AT EAR																																																		
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DBA) AT EAR																																																		
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)																																																		
NO PROTECTION																																																		
OASLC	105	104	103	102	101	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100																								
OASLA	105	104	103	102	101	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100																								
T	13	15	16	16	16	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6																								
MGU-2A/P HELMET WITH H-154	92	91	103	103	103	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99																								
OASLA*	120	120	143	143	143	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18																								
MGU-2A/P HELMET WITH H-154(A)	83	82	81	81	81	84	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85																								
OASLA*	571	679	807	807	807	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480																								
MGU-2A/P HELMET WITH CUSTOM LINER	96	95	94	94	94	96	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97																								
OASLA*	60	71	85	85	85	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60																								
T	7	8	9	9	9	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21																								
COMMUNICATION																																																		
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)																																																		
PSIL	98	97	96	96	96	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98																								
ANNOYANCE																																																		
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNDB)																																																		
TONE CORRECTION (C IN DB)																																																		
PNLT	121	120	120	120	120	121	121	121	121	121	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120																								
C	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																								

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

TABLE: MEASURES OF HUMAN NOISE EXPOSURE

3

NOISE SOURCE/SUBJECT:	OPERATION:	LOCATION/CONDITION
F-100F AIRCRAFT INFILIGHT NOISE LEVELS USAFSAM SURVEY - AUG 1963		
		1/AA 1/BB 1/CC

HAZARD/PROTECTION
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN OBC) AT EAR
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DBA) AT EAR
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)

NO PROTECTION	OASLC	109	113	120
	OASLA	110	113	121
	T	5	3.2	P
HGU-2A/P HELMET WITH H-154				
OASLA*	92	98	107	
T	120	42	9	
HGU-2A/P HELMET WITH H-154(A)				
OASLA*	88	93	96	
T	240	101	60	
HGU-2A/P HELMET WITH CUSTOM LINER				
OASLA*	102	104	106	
T	21	15	8	

COMMUNICATION
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)
PSIL

PSIL	103	106	110

ANNOYANCE
PERCEIVED NOISE LEVEL (PNL IN PNDB)
PNL

PNL	122	126	134

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.
P ADDITIONAL EAR PROTECTION REQUIRED.